SCHOOL OF CIPHER

Make

Cipher machines out of card, string, pins and a torch

BOOKLET 4 OF 5

WHAT IS INSIDE

Contents

FOR GROWN-UPS

Before you start

Five things to build out of card, string, a rod and a torch. Nothing here needs anything you would have to buy specially.

Printing

Print at **100 per cent**, not fit to page. Every template on the website carries a ruler line so you can check; if the bar does not measure ten centimetres, your printer has shrunk the page and the discs will not line up.

Safety, said once and meant

- **Craft knives:** an adult cuts. Ruler, cutting mat, and fingers behind the blade.
- **Pins and needles:** an adult fits them, and count them in and out.
- **Heat:** a warm bulb or a low iron, never a flame, never unattended.
- **Cord:** never around a neck, and away from anyone small enough to tangle.

What to do when it works

Send something. A machine that has never carried a real message to a real person is only a craft project.

BUILD 1

The scytale

A rod and a strip of paper. The oldest cipher machine there is, and it takes about ten minutes.

What you need

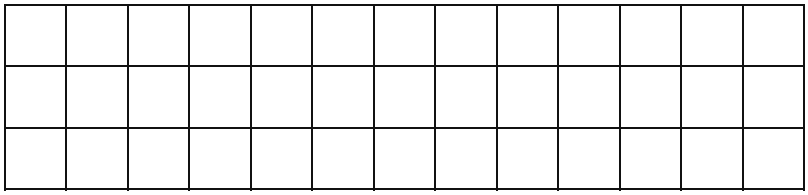
A round rod: a pencil, a rolling pin, a broom handle. A strip of paper two centimetres wide and as long as you can manage. Tape.

What to do

1. Tape one end of the strip to the rod.
2. Wind it round in a spiral so the edges touch but do not overlap.
3. Write your message **along** the rod, not around it.
4. Unwind. The letters are now scattered along a meaningless strip.
5. Send the strip. Never the rod.

Agree the object first. A different thickness of rod gives a different answer, so both of you use a pencil, or both use a broom handle.

Cut your strip from here



BUILD 2

The Caesar wheel

Two circles of letters and a pin. Turn it and the whole cipher changes.

What you need

Card, scissors, a split pin or a drawing pin with a rubber behind it, and the wheel template from schoolofcipher.com printed at full size.

What to do

1. Glue the template to card and let it dry flat.
2. Cut out both circles. Cut the small one slightly **inside** the line: a hair too big and it jams.
3. Pin them together through the middle so the inner circle spins.
4. Turn until A on the outside sits above your chosen letter. That letter is your key.
5. Read each message letter on the outer ring and write down what sits underneath.

Write the two alphabets by hand if you have no printer

A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X	Y	Z

Scramble the inner ring instead of writing it in order, and turn it every few words, and you have built an Alberti disk: a harder cipher, invented in the 1460s.

BUILD 3

Semaphore flags and a signal lamp

Flags, ten minutes

Two garden canes, dowels or wooden spoons. Two tea towels, ideally different colours. Tape a cloth along one edge of each stick.

1. Stand where they can see you: across a garden, a hall, a street.
2. Each arm goes in one of eight directions, forty five degrees apart.
3. Both arms straight down is rest, and marks the gap between letters.
4. Hold each letter still for two seconds. It is read when the flags stop.

A signal lamp, five minutes

A torch or a phone light, and the morse card from booklet two in both pockets.

1. Agree the speed first. A dot is about one second to start with, a dash three.
2. Cover the light between letters. Three dots of darkness means a new letter.
3. Send your name and wait for it to come back before going on.
4. Then try bouncing the beam off a wall or ceiling. It still arrives.

Never shine a torch into anybody's eyes, and never at a road or a car. Keep the flag sticks away from faces and windows.

BUILD 4

The knot code and the music box

A message you can wear

A metre of thin cord, and a strip of paper marked evenly to measure against.

1. Lay the cord along the marked strip.
2. A is one mark along, B is two, up to five, then start counting again for the next letter.
3. Tie a small tight knot at each letter, and a big knot between words.
4. Wear it. It looks like string, because it is string.

A drum that remembers a tune

A cardboard tube, a cheap comb, dressmaking pins, and an adult.

1. Wrap a grid round the tube: five rows for five notes, and columns for time.
2. Mark a dot wherever you want a note to sound.
3. An adult pushes a pin in at every dot, leaving a few millimetres standing out.
4. Hold the comb against the pins and turn the tube steadily.

Turn it too slowly and the tune is unrecognisable even though every pin is in the right place. A code sent through time only works if both ends agree how fast.

CREDITS

About this booklet

School of Cipher is a free set of lessons, animations and worksheets about codes, ciphers, signals and hiding messages, for code-breakers roughly aged seven to eleven.

How this was made. The writing, worksheets, diagrams and animations in this booklet were produced by **Claude**, an AI assistant made by Anthropic, working from a person's prompting, direction and curation. A human chose what the project should be, what belonged in it, what to cut, what was wrong, and what to keep. The AI did the drafting and the building.

Facts have been checked where checking was possible, and where a source could not be confirmed the claim was left out rather than guessed at. If you find a mistake, it is worth telling us: on a site about code-breaking, being corrected is the point.

Sources and further reading

Codes, Ciphers and Secret Writing by Martin Gardner is where this project started, and several of the earliest ciphers here follow his explanations.

Historical details have been drawn from public reference sources, museum material and the published records of the organisations named in the text.

Using this booklet

- Print at **100 per cent**, not fit to page, or any template will come out the wrong size.
- Photocopy freely for a class, a club or a family. No permission needed.
- Every sheet works on its own. There is no need to go in order.

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